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Pre-operational integrity test requirement for single-wall and double-wall USTs

The department's understanding of tank installation standards and expectations in the field is that any UST system, including double-wall systems, is required to pass a system tightness test after installation and prior to being placed in operation. Several recent issues have presented the need to revisit and modify pre-operational integrity test requirements:

- Environmental contamination from hydrocarbon vapors escaping from UST systems is becoming a fact and a concern.
- Tank inspectors researching the source of water appearing in tank systems have found the source to frequently be surface water migration into UST systems as a result of loose fittings.
- As the use of ethanol blended motor fuels increase the department needs to be proactive in eliminating water from entering storage systems that will have a significant detrimental effect on fuel quality.
- Resolve the issue of allowing a vacuum test of the interstice of a double-wall tank to determine both interstice and primary tank tightness,

The purpose of requiring a pre-operational system tightness test is to assess the integrity of the tank as well as fittings and appurtenance connections when the system installation is complete. In the process of addressing UST installation test procedures it was discovered that both contractor and inspector tightness evaluation of the tank connection(s) was not evaluated as expected and with the exception of a few contractors appears to be almost non existent. Tests were being performed on the tank and pressure tests conducted on the pipe prior to connection to the tank. Seldom were tests being performed on the system as a whole after the pipe was connected to the tank. Precision tests, as required by the department, were being conducted on the primary tank, but that test will not provide any assurance that the tank top fittings are tight.

Many double-wall tanks are shipped from the manufacturer with a vacuum on the interstice or a brine solution in the interstice, both with interstice leak monitoring capability. This leak monitoring may only cover the interstice or it may include the tank, but neither method is equivalent to a post-installation pre-operational system test. Inspectors are also experiencing that frequently contractors are not maintaining the test through the entire installation or to the termination point as required by the tank manufacturer.

One proponent of the interstice vacuum test as having pre-operational test merit is based upon the KWA Evaluation of the Permatank Interstitial Vacuum Monitor for Installation Testing. The purpose of the KWA evaluation was to determine if the STI vacuum monitor met the Federal EPA tank leak detection methodology criteria. The KWA evaluation states that "the test objective was to test the integrity of the tanks prior to installation." The evaluation also states that "Different procedures are required if the vacuum system is to be used for monitoring after product has been added to the tank." Therefore the KWA evaluation does not apply to preoperational leak detection methodology testing with product in the tank as required by Comm 10.

NFPA 30, 2000 & 2003 edition, require individual pre-operational testing of the interstice and the primary tank. NFPA 30 standard for underground secondary containment tanks is written to address the primary and interstitial individually. This was initially confirmed by NFPA.

> NFPA 30-4.4.2.3 Underground secondary containment tanks and horizontal aboveground secondary containment tanks shall have the primary (inner) tank tested for tightness either hydrostatically or with air pressure at not less than a gauge pressure of 20 kPa (3 psig) and not more than a gauge pressure of 35 kPa (5 psig). The interstitial space (annulus) of such tanks shall be tested either hydrostatically or with air pressure at a gauge pressure of 20 to 35 kPa (3 to 5 psig), by vacuum at 18 kPa (5.3 in. Hg), or in accordance with the tank's listing or manufacturer's instructions. The pressure or vacuum shall be held for not less than 1 hour or for the duration specified in the listing procedures for the tank. Care shall be taken to ensure that the interstitial space is not overpressured or subjected to excessive vacuum.

However, in a more recent communication from NFPA's Bob Benedetti, subsequent to his discussion with Wayne Geyer of the Storage Tank Institute, the NFPA position has been modified as expressed in the following:

> "While we agree that the literal text as now written requires that the primary (liquid-storing) vessel and the annular space be tested separately, I have to wonder if this might be overly restrictive in the case of a tank with a vacuum applied to the interstitial space at the factory and the vacuum is maintained through delivery and installation. If the vacuum does not decrease during all this time, should not this logically indicate that there is no leak in either the inner or outer wall of the tank? But the Code's text does not allow this, unless the authority having jurisdiction is willing to accept it under the Equivalency provisions of the Code (see Section 1.5). Note also that the same paragraph recognizes manufacturers' instructions for testing the interstitial space in lieu of the pressure and vacuum criteria."

As information relating to the resolution of this issue was being gathered a question was posed "What is the basis for the department's position that a pre-operational test must include the assessment of tank connection tightness, especially when product should never come in contact with the top of the tank?" As an answer to this question was researched we have discovered that much of this language has disappeared from manufacturer's directions and the standards are not definitively clear. A representative of one tank manufacture alluded to liability being a factor; since "they have no control over the pipe the tank installation instructions only address the tank."

A primary UST installation standard used by Commerce in the application of Comm 10 is PEI 100-05, which includes in section 14 Testing Before Placing the System in Service a requirement to "Tightness test tank and piping." We believe that logic plays a significant role here and the intent is that the system as a whole will be tested prior to operation. We believe this is supported by the STI Installation Instructions for FRP Jacketed Steel Underground Storage Tanks section 8.0 Tank Piping Connection Test states:

8.1 As the PTS already verifies tank tightness, one final test is still necessary to assure proper installation of the pipe connections to the tank fittings. Remove all factory-installed threaded protectors.

8.2 Pressure applied to the internal steel tank shall be 3-5 psi . . .

PEI RP 100 - 2.7 (2000 edition) states in a comment: "Alternative test procedures may not test primary tank openings, manways, and risers. These should be tested at some point during the installation."

During the period the department was gathering information regarding vacuum testing we heard from both inspectors and contractors of situations where the vacuum test indicated that the

primary tank was tight, but a subsequent pressure test resulted in leaks from some of the contractor installed fittings that were tight under a vacuum. This demonstrates that a vacuum test, while generally acceptable, is not always fail-safe.

The department evaluated an opinion that the tank sump hydrostatic test would be sufficient to demonstrate that the tank connections were tight. The department considered the various tank system configurations and the difference in the physical dynamics between an internal test and external test at the sump. The department believes that the hydrostatic test at the sump does not pose the same pressure (positive or negative pressure depending upon test) across the tank and therefore does not have the same reliability for the tank test as an internal test. An internal test places negative or positive pressure on the tank wall, connection fittings, etc., that to an extent mimics tank expansion and contraction in the everyday workings of the tank. The feedback from inspectors relating to the discovery of loose fittings during pressure testing or after-the-fact from water migration into the tank through loose connections has been surprising. The department also believes that establishing a policy based upon the various tank configurations renders more confusion to the issue.

Several people within the industry stated that WI Commerce is the only regulator that poses the subject requirements. Investigating this we have found that we are in concert with the expectations and interpretations of most tank regulators. The difference appears to be in the method and depth of regulatory oversight. The department also believes that the experiences with water migration into the tank via loose or missing fittings are amble justification to support the need for testing the connections. Recent findings on the extent of environmental contamination originating from hydrocarbon vapor migration from storage tank connections also support the need to assure that the tank system is installed tight.

Conclusion:

1. Neither the vacuum within the steel tanks' interstice or the brine within the FRP tanks' interstice are intended to test the final tank-to-pipe connection made in the field since this connection is not part of the secondary containment tank.
2. The department agrees that interstitial testing as recommended by the tank manufacturer is no less reliable than performing individual tests on the interstice and the primary tank. Therefore the interstice test will serve to comply with the intent of NFPA 30-4.4.2.3 for double-wall tanks.
3. An integrity test of the tank system connections is required to demonstrate that the system as installed is tight. While a pressure test is the preferred method, either vacuum or pressure integrity testing is acceptable for both single-wall and double-wall tanks under the oversight of the certified installer. This test is not considered leak detection under the EPA LD methodology protocols; therefore the system integrity test method does not have to have Commerce Material Approval.
4. The precision test as formerly required will no longer be required to verify tank tightness. However, the test may still be required by the leak detection, overfill or inventory control equipment manufacturer to verify or demonstrate that the leak detection, overfill or inventory control equipment is functioning properly. This should be addressed between the inspector and contractor during the pre-construction meeting.
5. The integrity test of the tank system connections shall be conducted for both new systems and TOS systems being brought back into service. The test shall be conducted in accordance with the tank's listing or manufacturer's instructions and shall be held for at least one hour without evidence of any leaks during that one hour time period.
6. Contractors will be expected to comply with the tank system integrity test requirements as expressed, for installations not yet in operation at the formal issuance of this program/policy letter. Such tests shall be documented and recorded on the installation records and installation checklist.